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ABSTRACT

Retrenchment is defined as the reduction of secondary and elementary school teachers. Retrenchment is carried out in two ways: reduce by program or reduce by teacher. In this paper the author proposes a mathematical model for use in reduction by teacher. The key educational manager for implementing the model is the building principal, who should be professionally prepared and personally dedicated. The retrenchment model is composed of 5 major categories and 10 subcategories that are used for teacher ranking. Teachers are compared to each other in norm groups by the same scorer to maintain reliability. It is important that the board of education have a policy regarding retrenchment and that the superintendent and principals know far enough in advance the number of teachers to be dismissed. (Author/MD)

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Retrenching Secondary and Elementary School Teachers: A Mathematical Model

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Running head: A MATHEMATICAL MODEL FOR RETRENCHING TEACHERS

Abstract

Retrenchment is the reduction of secondary and elementary school teachers. There are two ways to retrench: reduce by program or reduce by teacher. The author proposes a mathematical model to be utilized when reducing by teacher. The key educational manager for implementing the model is the building principal. The Retrenchment Model is general. Utilization at the secondary or elementary school levels is appropriate. Each teacher is compared to every other teacher in the norm group. Correlation across principals or schools is not appropriate.

Retrenching Secondary and Elementary School Teachers: A Mathematical Model

Retrenchment may be defined (for purposes of this proposal) as reduction-in-force of secondary and elementary school teachers due to declining enrollment or limited district finances. There are two ways to retrench teachers: reduce by program or reduce by teacher.

Taxpayer revolts have led to increasing concerns about accountability (Bowser, 1982). The role and the function of the school and staff is being questioned by community citizens, parents, and educational personnel.

This writer contends these increasing taxpayer concerns will make raising taxes to finance the educational program difficult. If additional revenues are not available to fund the schools the only real choice is retrenchment. This should be accomplished through reduction by teacher rather than reduction by program.

Reduction by teacher is more appropriate than reduction by program. A curricular program is not functional with poor instruction. Therefore, teachers must be evaluated for retrenchment in addition to being evaluated for personnel development. Millman (1982) has identified five categories of evidence for use in teacher assessment. These include pre-existing teacher characteristics, which can be used in selection of applicants in a teacher-educational training program; teacher competence; teacher performance; pupil learning experiences; and pupil outcomes. Teacher performance, achievement in the classroom and in non-instructional responsibilities, is the basis for the proposed model.

The key educational manager for implementing the model is the building principal. Unfortunately, doubt still exists concerning the positive effect of supervision by the principal (DeBovise, 1982). Pellicer (1981) confirms the role of the principal is rapidly changing. However, principals must be given greater autonomy within their building (Seifert, 1982). But some

(Crowson and Morris, 1982) believe the principalship must be analyzed and understood not according to some received canon of professional conduct but rather in terms of the operative goals of the organization over which the principal presides. This is the basis for use of the principal as the key educational manager in the model.

The proposed model is general. A practical way to facilitate use of the model is through the planning tools most appropriate for the local district.

Retrenchment by teacher, not program, is the basis of the model.

Qualifications of the Principal

The key to the Retrenchment Model is the principal. Without a qualified and highly effective principal the model should not be utilized. Two key attributes must be possessed by the principal: professional preparation and personal dedication.

Professional preparation in school administration includes eight areas of training. These include general school administration, supervision, school law, school finance, school public relations, school plant, personnel administration, and curriculum. Unfortunately, many principals are minimally qualified regarding teacher evaluation. To insure adequate preparation on the part of the principal the local board of education should employ principals with a maximum amount of professional preparation in the area of educational management. Sixty hours of graduate work with at least forty hours in educational management should be the minimum qualifications for professional preparation of principals. A principal with a

graduate degree in a subject specialty (physical education, art, math, etc.) and minimum additional qualifying hours for certification purposes (four or five classes in school administration) is not qualified to implement the model.

Personal dedication is a minimum qualification for a principal. To be effective the principal must be competent in and have a love for personnel administration including hiring, personnel development, and teacher evaluation. At least one third of each day should be devoted to the professional improvement of the teaching staff. Teacher evaluations are not a matter to be left to the last minute or to be completed after all other tasks are finished. Being an effective principal is hard work, time consuming, and fun.

Time management is essential to devote the time required to implement the model. Teacher evaluation is to be a function of the building principal. Other tasks (discipline, assigning ticket takers for home basketball games, lunch duty, etc.) can be accomplished by the vice-principal or athletic director.

Retrenchment Model Clarification

The Retrenchment Model is composed of five major categories. Each of the five major categories is composed of two sub-categories. Each of the ten sub-categories is computed at ten percent of the total model. No sub-category is quantified more or less than any other sub-category.

The Retrenchment Model is norm-referenced. Each teacher is evaluated relating to performance in comparison to every other teacher being observed. Teachers are not compared to a standard of content or criterion. Teachers are not compared to only those teachers in their same teaching specialty. The Retrenchment Model is designed to measure teaching effectiveness as differentiated between all classroom teachers in the norm group.

Each of the ten sub-categories is norm-referenced. All teachers will receive a score in each of the ten sub-categories. All teachers will receive an overall score based on the mean of each of the ten sub-categories. The overall score is the measure of teaching effectiveness.

The principal must rank order each teacher on all ten sub-categories. The principal must rank order each teacher on the overall mean score.

Each of the ten sub-categories is divided into ten points. To find the point value for a given teacher in a given sub-category the principal converts the placement of the teacher in the sub-category into a percentile. For example, with forty teachers each of the top four teachers is in the top ten percent. Each of these four teachers will receive ten points for the sub-category. Each of the next four teachers will receive nine points. The four teachers ranked at the lower end of the sub-category will receive one point each. Each teacher will receive a score for the ten sub-categories.

There is a maximum of one hundred points if a given teacher scores in the top ten percent of each of the ten sub-categories. There is a minimum score of ten points.

The final score is the mean of each of the ten sub-scores. The principal divides the overall score by ten to obtain the mean score. Each of the teachers in the mean group is ranked from most effective to least effective based on the mean score.

For retrenchment purposes, if four teachers must be non-renewed, the four teachers with the lowest teacher effectiveness mean score should be dismissed. The district must follow the law regarding equal opportunity and tenure.

There may be a problem if two of the teachers in the lowest ten percent are in the same subject specialty. The writer contends a given program is weakened by ineffective instruction. If two of the four teachers fall in this category that part of the curriculum is weak. Hopefully, both of the instructors are not tenured.

Teachers should be evaluated on the number of high or low mean scores in the sub-categories. If a given teacher scores in the bottom ten percent on seven different sub-categories teaching is not effective.

The Retrenchment Model is general in nature. If a district wishes to place more or less emphasis on a given sub-category substitutions should be made. The model must have ten sub-categories to be effective.

Retrenchment Model

I. The Teacher as an Individual the Person

A. Discipline

1. maintains a classroom atmosphere where desirable attitudes are developed
2. accepts responsibility for continuous classroom supervision and non-classroom supervision
3. adheres to school policy
4. common sense

B. Relationship with Students

1. develops and maintains good rapport with students
2. approachable, alert, available, cooperative, and courteous
3. enthusiastic, realistic, responsible, and tolerant
4. uses a variety and scope of classroom activities resulting in student participation

Retrenchment Model

II. The Teacher as an Instructor the Teacher

A. Professional

1. knowledge of subject matter
2. speech: use of English, free from distracting habits, and proper grammar
3. care in personal appearance and grooming
4. prompt in arrival at school and observes other required time schedules

B. Personal

1. interpersonal communication with certified and non-certified personnel
2. receptive to other ideas, encouragement of student participation in class activities, and cooperation
3. cheerful and optomistic
4. exercises good judgment and tact

Retrenchment Model

III. The Teacher as an Instructor the Person

A. Keeps Course Material Current and in Writing

1. depth of course syllabus
2. valid lesson plans: clear, meaningful, and submitted on time
3. effective use of school facilities, equipment, inventory, materials, and supplies
4. adjusts physical features to maintain a wholesome classroom environment

B. Justifiable and Consistent Grading System

1. validity: quantifiable, tests cover lesson plan assignments, wording of questions on examinations, and test preparation
2. reliability: adequate number of tests and classroom assignments
3. useful: expectations of students appropriate for the level of the course
4. accurate gradebook for student absences, tardies, and grade justification

Retrenchment Model

IV. The Teacher as a Professional the Person

A. Professional Ethics

1. emotional stability
2. condition of health permits regular attendance and necessary activity
3. maturity through self-control
4. respects the opinions, abilities, and contributions of others

B. Professional Activities

1. membership in professional teaching associations
2. attendance at professional meetings
3. leadership roles in professional associations and meetings
4. self-development activities

Retrenchment Model

V. The Teacher as a Member of the School and Community

the Person

A. School Activities

1. attendance at school events
2. sponsorship of athletic activities and non-athletic activities
3. membership on school committees related to the total curriculum
4. assumes share of school responsibilities

B. Community Activities

1. interpersonal communication with parents and community citizens
2. active participation in community activities
3. work with students in community activities
4. membership in community groups

Retrenchment Model Quantification Clarification

Each of the ten sub-categories is norm renced. The principal must rank order each of the teachers on all ten sub-categories. The principal must rank order each of the teachers on the overall mean score. The Retrenchment Model Quantification is a guide to ranking each teacher in the sub-categories.

Many times the quantification will be accomplished through observation by the principal. A trained and professional principal should be able to compare each of the teachers to the other teachers in a given area. A minimum of four classroom observations per teacher should be made to have a reliable score on any one of the sub-categories. Two observations per semester should be sufficient. The principal will observe the teacher in non-classroom activities in addition to the classroom observations.

Within the Retrenchment Model there are times when the teacher submits material to be evaluated (lesson plans, course syllabus, how physical features were maintained, etc.)

The principal is to rank order teachers based on the material submitted by the teachers.

There are sub-categories in which the teacher submits quantifiable material to be evaluated (number of days and activities missed due to condition of health, list of memberships in professional teaching associations, attendance at professional meetings, etc.). The principal is to rank order teachers based on the quantifiable variable.

There are four qualifying factors per sub-category. The principal can determine if each of the categories should carry the same weight or if one of the qualifying factors should carry more weight than the other qualifying factors in a given sub-category. Regardless of the option the sub-category will have one score per teacher.

Before using the Retrenchment Model the principal must decide how to assign point values for quantification. The same variables should be used with each teacher. This quantification should be in writing.

Retrenchment Model Quantification

I. The Teacher as an Individual the Person

A. Discipline

1. classroom observation by the principal
2. observation by the principal
3. observation by the principal
4. observation by the principal

B. Relationship with Students

1. observation by the principal
2. observation by the principal
3. observation by the principal
4. teacher submits weekly lesson plans: evaluation by the principal

Retrenchment Model Quantification

II. The Teacher as an Instructor the Teacher

A. Professional

1. observation by the principal
2. observation by the principal
3. observation by the principal
4. observation by the principal

B. Personal

1. observation by the principal
2. observation by the principal
3. observation by the principal
4. observation by the principal

Retrenchment Model Quantification

III. The Teacher as an Instructor the Person

A. Keeps Course Material Current and in Writing

1. teacher submits written course syllabus: evaluation by the principal
2. teacher submits weekly lesson plans: evaluation by the principal
3. teacher submits list of use of school facilities, equipment, inventory, materials, and supplies: evaluation by the principal
4. teacher submits list of how physical features were maintained

B. Justifiable and Consistent Grading System

1. teacher submits all classroom tests before test administration: evaluation of tests by the principal
2. teacher submits grade book: evaluation by the principal
3. evaluation of tests and grade book by the principal
4. evaluation of grade book by the principal

Retrenchment Model Quantification

IV. The Teacher as a Professional the Person

A. Professional Ethics

1. observation by the principal
2. teacher submits number of days and activities missed due to condition of health
3. observation by the principal
4. observation by the principal

B. Professional Activities

1. teacher submits list of memberships in professional teaching associations
2. teacher submits list of attendance at professional meetings
3. teacher submits list of leadership roles in professional associations and meetings
4. teacher submits list of self-development activities

Retrenchment Model Quantification

V. The Teacher as a Member of the School and Community the Person

A. School Activities

1. teacher submits list of attendance at school events
2. teacher submits list of sponsorship of athletic and non-athletic activities
3. teacher submits list of membership on school committees related to the total curriculum
4. teacher submits list of school responsibilities

B. Community Activities

1. teacher submits list of interpersonal communication techniques with parents and community citizens
2. teacher submits list of participation in community activities
3. teacher submits list of work with students in community activities
4. teacher submits list of membership in community groups

Utilization of the Retrenchment Model

The Retrenchment Model may be used with teachers at the secondary or elementary levels. Effective teaching requires minimum efficiency in discipline, relationship with students, justifiable and consistent grading systems, etc. These variables are important regardless of the grade level or subject taught by the teacher.

When utilizing the Retrenchment Model teachers should be placed in norm groups according to principal. The comparison to a norm group is by principal. The Retrenchment Model is not intended to compare secondary school teachers with elementary school teachers. Mean scores are not to be compared across principals or schools.

To maintain reliability the same scorer (principal) must be utilized for the norm group. Vice-principals should not evaluate teachers as this is the responsibility of the principal.

When instructors teach in more than one building or grade level (music, art, physical education, etc.) the

teacher should be placed in the norm group in which he/she has the major teaching assignment. For example, if a vocal music teacher is assigned four class periods a day in School "A" and two class periods a day in School "B," the teacher should be placed in the norm group at School "A." If the teaching assignments are identical in two or more schools the teacher should be placed in all norm groups and evaluated by each of the principals.

The Board of Education should have a policy regarding retrenchment. The superintendent and principals must know how many teachers are to be dismissed far enough in advance so preparation can be made to alter the curriculum.

If a district has a total of one hundred teachers and five teachers must be retrenched, the five teachers should not be from the same school or level (secondary or elementary). There is the chance all of the teachers in the lowest five percent of teaching efficiency come from the same school or principal. The Board of Education

should not assume these are the five least effective teachers in the entire school district. These teachers are the five least effective teachers in a given building. The Retrenchment Model may be used with teachers at the secondary or elementary school levels. Mean scores are not to be compared across principals or schools.

Example

The principal has been notified four teachers must be retrenched from a total of forty teachers.

Procedure

1. Given: N = 40
2. Given: number of teachers to be retrenched = 4
3. The principal will assign a nominal designation to each of the forty teachers (#1, #2, #3, etc.).
4. The principal will rank order each of the forty teachers on each of the ten sub-categories.
5. The principal will assign ranking points to each teacher based on the rank in each of the ten sub-categories. Ranking points will be assigned through use of the following system:

ranks	ranking points (per category)	
1 through 4	10	(most effective)
5 through 8	9	
9 through 12	8	
13 through 16	7	
17 through 20	6	
21 through 24	5	
25 through 28	4	
29 through 32	3	
33 through 36	2	
37 through 40	1	(least effective)

(note: four teachers will receive the same number of ranking points per sub-category)

6. total the ranking points
7. calculate the mean of the ranking points
8. calculate the rank (overall)
9. retrench the four lowest ranks (overall)

Ranks

#	IA	IB	IIA	IIB	IIIA	IIIB	IVA	IVB	VA	VB
1	21	24	29	33	37	25	34	30	33	29
2	40	37	33	40	35	39	33	29	21	25
3	18	13	24	23	24	26	20	21	9	17
4	17	32	37	29	29	40	40	36	40	31
5	22	38	40	30	32	29	21	23	36	30
6	2	8	13	5	20	20	19	22	12	18
7	33	25	34	34	38	37	39	33	37	37
8	19	26	28	17	25	30	22	13	23	19
9	1	5	9	20	17	19	2	9	13	6
10	14	17	12	19	19	17	23	32	11	7
11	36	33	39	35	26	13	24	25	25	28
12	5	1	4	8	8	12	13	15	16	20
13	6	4	1	6	3	8	18	14	1	5
14	12	31	11	9	13	14	25	16	24	27
15	39	15	36	39	36	27	35	40	38	38
16	16	6	2	13	18	9	17	20	15	24
17	34	39	30	38	27	38	38	35	39	39
18	15	18	5	18	15	15	11	8	2	1
19	35	19	23	31	14	31	10	17	4	2
20	13	34	10	1	10	5	12	10	8	8
21	25	40	6	4	16	6	14	12	20	13
22	23	28	27	2	1	1	1	11	14	14
23	9	14	14	14	23	21	16	28	27	26
24	32	20	22	32	40	18	15	39	34	40
25	38	29	35	26	30	35	36	31	35	36
26	31	16	26	3	2	7	5	3	6	8
27	28	30	25	25	33	34	31	34	32	35
28	26	27	31	28	9	28	32	18	19	16
29	4	3	3	7	11	2	4	2	7	4
30	10	9	15	16	7	4	3	1	3	3
31	29	10	18	10	12	10	7	19	26	23
32	8	2	16	15	4	16	8	7	18	15
33	27	11	20	27	22	33	26	4	17	7
34	37	35	38	37	34	36	30	37	31	34
35	24	23	32	36	39	32	37	24	30	33
36	7	12	7	11	5	3	9	5	5	9
37	30	22	17	22	21	24	29	27	28	22
38	20	36	19	24	31	23	28	26	29	32
39	3	7	8	12	6	11	6	6	10	12
40	11	21	21	21	28	22	27	38	22	21

Computation

#	IA	IB	IIA	IIB	IIIA	IIIB	IVA	IVB	VA	VB	Total	Mean	Rank
1	5	5	3	2	1	4	2	3	2	3	31	3.1	30.5
2	1	1	2	1	2	1	2	3	5	4	22	2.2	36.0
3	6	7	5	5	5	4	6	5	8	6	57	5.7	20.5
4	6	3	1	3	3	1	1	2	1	3	24	2.4	34.5
5	5	1	1	3	3	3	5	5	2	3	31	3.1	30.5
6	10	9	7	9	6	6	6	5	8	6	72	7.2	15.0
7	2	4	2	2	1	1	1	2	1	1	17	1.7	38.5
8	6	4	4	6	4	3	5	7	5	6	50	5.0	22.5
9	10	9	8	6	6	6	10	8	7	9	79	7.9	9.0
10	7	6	8	6	6	6	5	3	8	9	64	6.4	17.0
11	2	2	1	2	4	7	5	4	4	4	35	3.5	28.5
12	9	10	10	9	9	8	7	7	7	6	82	8.2	6.0
13	9	10	10	9	10	9	6	7	10	9	89	8.9	2.5
14	8	3	8	8	7	7	4	7	5	4	61	6.1	18.0
15	1	1	2	1	2	4	2	1	1	1	16	1.6	40.0
16	7	9	10	7	6	8	6	6	7	5	71	7.1	15.0
17	2	1	3	1	4	1	1	2	1	1	17	1.7	38.5
18	7	6	9	6	7	7	8	9	10	10	79	7.9	9.0
19	2	6	5	3	7	3	8	6	10	10	50	5.0	22.5
20	7	2	8	10	8	9	8	8	9	9	78	7.8	11.0
21	4	1	9	10	7	9	7	8	6	7	74	7.4	13.0
22	5	4	4	10	10	10	10	8	7	7	75	7.5	12.0
23	8	7	7	7	5	5	7	4	4	4	58	5.8	19.0
24	3	6	5	3	1	6	7	1	2	1	35	3.5	28.5
25	1	3	2	4	3	2	2	3	2	2	24	2.4	34.5
26	3	7	4	10	10	9	9	10	9	8	79	7.9	9.0
27	4	3	4	4	2	2	3	2	3	2	28	2.8	32.5
28	4	4	3	4	8	4	3	6	6	7	49	4.9	24.0
29	10	10	10	9	8	10	10	10	9	10	96	9.6	1.0
30	8	8	7	7	9	10	10	10	10	10	89	8.9	2.5
31	3	8	6	8	8	8	9	6	4	5	65	6.5	16.0
32	9	10	7	7	10	7	9	9	6	7	81	8.1	7.0
33	4	8	6	4	5	2	4	10	6	8	57	5.7	20.5
34	1	2	1	1	2	2	3	1	3	2	18	1.8	37.0
35	3	5	3	2	1	3	1	5	3	2	28	2.8	32.5
36	9	8	9	8	9	10	8	9	9	8	87	8.7	4.5
37	5	5	6	5	5	5	3	4	4	5	47	4.7	25.5
38	6	2	6	5	3	5	4	4	3	3	41	4.1	27.0
39	10	9	9	8	9	8	9	9	8	8	87	8.7	4.5
40	8	5	5	5	4	5	4	1	5	5	47	4.7	25.5

Findings

Overall Mean	(f)	Rank of Overall Mean
9.6	1	1.0
8.9	2	2.5
8.7	2	4.5
8.2	1	6.0
8.1	1	7.0
7.9	3	9.0
7.8	1	11.0
7.5	1	12.0
7.4	1	13.0
7.2	1	14.0
7.1	1	15.0
6.5	1	16.0
6.4	1	17.0
6.1	1	18.0
5.8	1	19.0
5.7	2	20.5
5.0	2	22.5
4.9	1	24.0
4.7	2	25.5
4.1	1	27.0
3.5	2	28.5
3.1	2	30.5
2.8	2	32.5
2.4	2	34.5
2.2	1	36.0
1.8	1	37.0
1.7	2	38.5
1.6	1	40.0
	40	

Recommendation

If four teachers are to be retrenched the four lowest teacher effeciency rankings include the overall means of 1.6 (1), 1.7 (2), and 1.8 (1). Teachers 15 (1.6), 7 (1.7), 17 (1.7), and 34 (1.8) should be retrenched.

Summary

There are two ways to retrench teachers: reduce by program or reduce by teacher. The proposed model is to be used when utilizing the option of retrenching by teacher.

The key educational manager for implementing the model is the principal. The principal can facilitate use of the model through planning options most appropriate to the local school district.

Norm-referencing is used. Each teacher is compared in performance to every other teacher being observed by the principal. Each of the teachers in the mean group is ranked from most effective to least effective based on the mean score. Use of the retrenchment model is appropriate at the secondary or elementary school levels. Mean scores are not not to be compared across principals or schools.

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Appendix A Retrenchment Model

		Rank	Points
I.	The Teacher as an Individual the Person		
	A. Discipline	___	_____
	B. Relationship With Students	___	_____
II.	The Teacher as an Instructor the Teacher		
	A. Professional	___	_____
	B. Personal	___	_____
III.	The Teacher as an Instructor the Person		
	A. Keeps Course Material Current and in Writing	___	_____
	B. Justifiable and Consistent Grading System	___	_____
IV.	The Teacher as a Professional the Person		
	A. Professional Ethics	___	_____
	B. Professional Activities	___	_____
V.	The Teacher as a Member of the School and Community the Person		
	A. School Activities	___	_____
	B. Community Activities	___	_____

Total Points _____

Overall Rank _____

Teacher # _____

Appendix B

Ranks

#	IA	IB	IIA	IIB	IIIA	IIIB	IVA	IVB	VA	VB
1										
2										
3										
4										
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Appendix C Computation

#	IA	IB	IIA	IIB	IIIA	IIIB	IVA	IVB	VA	VB	Total	Mean	Rank
1													
2													
3													
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Appendix D Findings

Overall Mean ($\bar{x}$) Rank of Overall Mean

(N)

Recommendation